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ABSTRACT

The studies in section six (of a six part report on the assessment and treatment of deviant behavior in children) investigated questions generated by the application of the treatment model in the experimental class setting (EC 032 210). The first experiment, on attending behavior, was designed to measure the conditionability of attending behavior using a changing schedule of requirements for reinforcement. Manipulation of the reinforcing contingencies were felt to produce measurable changes in the proportion of attending behavior. The experiment on effects of reinforcement, feedback, and punishment on academic response rate was designed to provide data on optimum combinations of consequence variables for improving academic performance. Results were felt to indicate that positive reinforcement and feedback were effective in accelerating rate correct and decelerating error rate. Punishment of specific error responses were noted as proving effective. The experiment on increasing cooperative social interactions with group reinforcement procedures was investigated using six subjects with deviant behavior in a playground situation. The data was felt to suggest that social interactions could be altered through positive reinforcement. (CD)

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Final Report

Section Six: Single Subject Experiments Generated by Application
of the Treatment Model in the Experimental Class
Setting

Assessment and Treatment of
Deviant Behavior in Children

U. S. O. E. Contract OEG 4-6-061308-0571

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THE USE OF POSITIVE REINFORCEMENT IN
CONDITIONING ATTENDING BEHAVIOR¹

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ABSTRACT

Individual conditioning techniques were applied in a controlled setting to increase attending behavior of an underachieving nine-year-old male subject. The procedure involved (1) determining a stable response pattern, (2) introducing a treatment variable to establish a high rate of task-attending behavior, (3) measuring the effect of withdrawal of the treatment variable after attaining criterion performance, and (4) transferring control to the classroom. The interval of attending behavior required for reinforcement was systematically increased from 30 seconds to 600 seconds as the behavior came under experimental control. Manipulation of the reinforcing contingencies in this study produced measurable changes in the proportion of attending behavior and in the frequency and duration of non-attending events. Once the behaviors were under experimental control, procedures were established for programming generalization and maintenance of the behavior outside the experimental setting.

THE USE OF POSITIVE REINFORCEMENT IN
CONDITIONING ATTENDING BEHAVIOR¹

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In the last decade, conditioning techniques have been used effectively to shape a variety of response classes in children (e.g., Patterson, 1965a, 1965b; Wolf, Risley, and Mees, 1964; Williams, 1959; Hart, Allen, Buell, Harris, and Wolf, 1964). Conditioning techniques have been applied to parent-child interactions, hyperactivity, vomiting, stuttering, tantrums, operant crying, and encopresis in order to modify these behaviors in preferred directions. The results of these studies have provided impressive evidence for the efficacy and generality of these techniques.

Two important features of these techniques are that they have been applied under carefully controlled conditions and have focused on the behavior of individual subjects. The application of conditioning techniques in single subject designs allows for the manipulation of setting events and reinforcing stimuli as well as for the evaluation of treatment effects by (1) establishing stable response rates, (2) introducing a treatment or controlling variable, and (3) withdrawing that variable (after criterion performance) in order to measure its effect upon behavior.

The purpose of this study was to evaluate the effects of a shaping program for attending behavior of a nine-year-old subject and the transfer of the control to the regular classroom.

PROCEDURES AND RESULTS

Subject and Setting

Phillip was a bright (WISC: 116), underachieving male who, upon referral, exhibited a number of deviant behaviors that were incompatible with successful, task-oriented performance in the classroom setting. Phillip was enrolled in the fourth grade and his chronological age at referral was 9-6. His deviant behaviors in the classroom reportedly included verbally and physically provoking other children, not completing tasks, making loud noises and comments, coercing attention from the teacher, talking out of turn, and being easily distracted from a given task by ordinary classroom stimuli such as minor noises, movements of others, changes in lighting conditions, and a number of other stimuli common to a classroom setting. Observations in the classroom indicated he attended to assignments only 42% of the time.

The subject was enrolled in an experimental class for behaviorally disordered children during two months of the academic school year 1966-67. Behaviors which were directly incompatible with appropriate social behavior and successful academic performance gradually decreased in frequency as Phillip's behavior came under control of the response reinforcement contingencies operating within the experimental class setting. His academic task rate increased markedly and his social behaviors became more appropriate and more easily tolerated by his peers. (Walker and Mattson, 1967) Phillip's distractive behavior, however, maintained at a high rate, even though consequences such as teacher approval and points earned for tangible objects were consistently withheld when he was not attending to his assignment.

Phillip's attending behavior was task specific (Moyer and von Faller Gilner, 1955) in that it varied with the given assignment. He worked on a

programmed reading text (Sullivan Series) but produced very little from teacher assigned work such as math problems. His attending behavior continued at a low rate in spite of "treatment," apparently because of the experimenter's inability to manipulate such controlling variables as: a large number of potentially distracting stimuli in the treatment setting, attention from peers for distractive behavior, escape from academic work and reinforcement from frequent substitute activities (Goldstein and Seigle, 1961). As this behavior could not be controlled effectively in the experimental setting, an individual conditioning program was designed for administration in a setting where these sources of distractive stimuli could be controlled.

The educational task during baseline and treatment sessions consisted of programmed learning material. The subtraction and addition texts A-B, Lessons for Self-Instruction in the Basic Skills published by the California Test Bureau, were used throughout the conditioning program. The same texts were used in an attempt to control interest and difficulty factors. The programmed texts also reduced the number of task related questions that the subject had to ask for purposes of explanation and clarification. No feedback was provided about the correctness of responses other than that provided by the text.

The subject participated in 40-minute experimental sessions five days a week. The treatment periods each day were divided into three ten-minute time blocks with three minute breaks occurring after the first and second ten-minute block each day. Treatment sessions were conducted in a setting where extraneous stimuli were reduced to a minimum. The setting contained a table, two chairs, a lamp, and the educational task material used by the subject.

When the subject's task rate and attending behavior had stabilized (Sidman, 1960) during baseline observations, the operational contingencies were verbally specified to the subject immediately prior to the beginning of treatment. The subject was instructed that when a given interval of time had elapsed, in which no distractions had occurred, a click would sound and the experimenter would enter a single check mark in a cumulative recording form. The subject was told that attending to the click represented a distraction and would result in loss of reinforcement for that interval. The subject was allowed to exchange his points for a model of his choice at the conclusion of the treatment period. The number of points necessary for the model (160 points) was specified to the child at the onset of treatment.

The response measure in this study was established in accordance with Martin and Powers (1967) operant conditioning analysis of attention span. Attending behaviors for the subject involved looking at the assigned page, working problems and recording responses. Non-attending behaviors were defined as those behaviors which were incompatible with task-oriented (attending) behavior. The following observable behaviors were classified as non-attending events: (a) looking away from the text and answer sheet by eye movements or head turning; (b) bringing an object into his field of vision with head and eyes directed toward paper (other than pencil, book and answer sheet necessary for the task); and (c) making marks other than those necessary for the task (e.g., doodling).

During recording, the following notational system was used: (a) Z = beginning of a new attending period, (b) √ = continuation of the same event through successive ten second intervals, (c) / = a reinforcement (an audible

click indicated reinforcement), and (d) -- = subject attended to the click. A sample observation is given in Fig. 1.

 Insert Figure 1 about here

The data in Fig. 1 is decoded as follows: Phillip was reinforced for producing 60 seconds of attending behavior (interval six); attended to the sound of the click and immediately lost the point he had earned (interval seven); the non-attending sequence continued through the next seven intervals (interval 14); a new sequence of attending behavior occurred in intervals 15 and continued through 18 followed by 30 seconds of non-attending; a new attending behavior began and terminated in interval 22 followed by a distraction (interval 23); attending behavior started in interval 24 and continued through interval 30 with the subject receiving reinforcement after interval 29.

Before the data collection process began, the senior author took simultaneous recordings of Phillip's attending behavior with observers who recorded his performance throughout the experiment. Inter-rater reliabilities were calculated by a percent agreement method where number of agreements were divided by the total number of time intervals. These reliabilities ranged from .65 to .98. The initial training sessions were terminated when inter-rater reliability was .90 or above for five randomly selected time samples (10 minutes) of attending behavior. These simultaneous recordings were also taken periodically during the treatment process in order to provide a continual check on the inter-observer reliability. In addition, a separate record of total time attending and number of reinforcing events per session was kept by the experimenters. These recordings provided for an additional measure of agreement between observer recordings.

The intervals of attending behavior which met the criterion for reinforcement were: (a) 30", (b) 60", (c) 120", (d) 240", (e) 480", and (f) 600". When Phillip had completed 20 intervals of 30 seconds duration in which no non-attending sequences had occurred, the interval length was doubled to 60 seconds. Thus, to proceed from one response interval criterion to another, the subject had to produce ten minutes of attending behavior, e.g., 20 x 30 seconds equals 600 seconds or ten minutes, or 10 x 60 seconds equals 600 seconds or ten minutes total. The conditioning program was administered according to the schedule in Table 1.

 Insert Table 1 about here

During the initial criterion interval of 30 seconds, one point was administered on 20 separate occasions. In the final criterion interval of 600 seconds, a total of 20 points was administered on one occasion (at completion of the interval). The reinforcement contingency was withdrawn when the subject had completed three ten minute distraction free intervals in succession.

Results

 Insert Figures 2 & 3 about here

When the subject's behavior had returned to baseline levels following withdrawal of the reinforcement contingency, Phillip was placed on a variable interval schedule in the regular classroom setting where he was reinforced (on the average) with one point for each 30 minute bloc of attending behavior. This 30 minute bloc of time was consistent with the

criterion interval for Phillip's attending behavior in the laboratory setting and one which his teacher could reasonably manage in the regular classroom.

A point record form was placed on Phillip's desk each day in the regular classroom. Phillip's teacher was provided with a variable interval schedule on which she gave one point to Phillip, on the average, of every 30 minutes of appropriate attending behavior. If Phillip engaged in other than appropriate attending behavior, the teacher was instructed to withhold reinforcement for that interval in which it occurred. The follow-up data are presented in Fig. 4.

 Insert Figure 4 about here

Discussion

As the data in Fig. 2 and Fig. 3 attest, a systematic manipulation of the reinforcement contingency in this study produced measurable changes in the response measures of percentage of attending behavior and frequency and duration of non-attending behavioral events. In Fig. 2 the subject's proportion base output of attending behavior during pretreatment and extinction sessions was .33 and .44 respectively. During treatment, the subject's mean output of attending behavior was .93. These data further suggest that the subject's behavior rapidly came under experimental control and remained under control until the reinforcement contingency was withdrawn at the termination of criterion performance. Upon withdrawal, the behavior returned to pretreatment levels, thus indicating that the alteration in behavior was due to the manipulated, experimental variable rather than to the influence of an unknown or chance variable.

In Fig. 3 the response measures of duration and frequency of non-attending events display a similar alteration in rate in conjunction with manipulation of the experimental variable. During baseline, the mean duration of non-attending events was 21 seconds and the mean frequency was 19 non-attending events per ten minute time sample. These rates were reduced to zero by the end of the treatment period. During extinction, frequency of non-attending behaviors returned to pretreatment levels. However, the duration of these events rose far above its baseline rate. When the contingency was withdrawn, there was a series of sharp, fluctuating bursts in the response rate which suggests that the emotional effects of extinction might have been reflected in the subject's performance. He made such comments as "I'm tired," "What time is it?" and "When will we be through?" During one session, the subject sat motionless for an entire session (45 minutes) and refused to attend to the task.

During reinstatement of the contingency following reversal, Phillip reconditioned quickly. (See Fig. 4.) As indicated earlier, Phillip was placed on a variable interval thirty minute schedule of reinforcement where he was reinforced on an average of once per 30 minutes for producing task-oriented, distraction-free behavior. The data in Fig. 4 were taken in a regular classroom setting where the number of potentially distracting stimuli was much greater than in the controlled setting where the subject was initially conditioned. Each tangible reinforcing event was accompanied by the administration of attention, praise, and social approval from the teacher. It is hoped that the higher rates of attending behavior produced by the subject will come under the control of such natural reinforcers as task completion, positive feedback, academic success, and the acquisition of new knowledge.

The functional analysis of Phillip's attending behavior suggests that individual conditioning techniques can be used to acquire efficient, reinforcement control over behaviors which are difficult to modify in regular classroom settings. Once the behavior has been brought under experimental control, procedures can be established for programming generalization and maintenance of the modified performance in settings where maintaining stimuli operate in an uncontrolled fashion. The results of this study appear to have implications for treatment of a variety of subject specific behaviors which actively interfere with successful academic performance among children in the educational setting.

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Footnotes

- 1 The mimeographed copy is based on the original manuscript by the authors. Minor editorial changes appear in the printed article.
- 2 The authors gratefully acknowledge the assistance of Sister Eleanor Barbara from the Christie School in Portland, Oregon, for her efforts in recording data during the experiment.

Table 1

Gradoated Scale For Changing
Response Intervals and Administering Reinforcers

# of Successfully Completed Intervals	Duration of Interval	# of Reinforcers Received
		(Events) (Points)
20	30 sec.	20 x 1
10	60 sec.	10 x 2
5	120 sec.	5 x 4
2.5	240 sec.	2.5 x 8
1.2	480 sec.	1.2 x 16
1 *	600 sec.	1 x 20

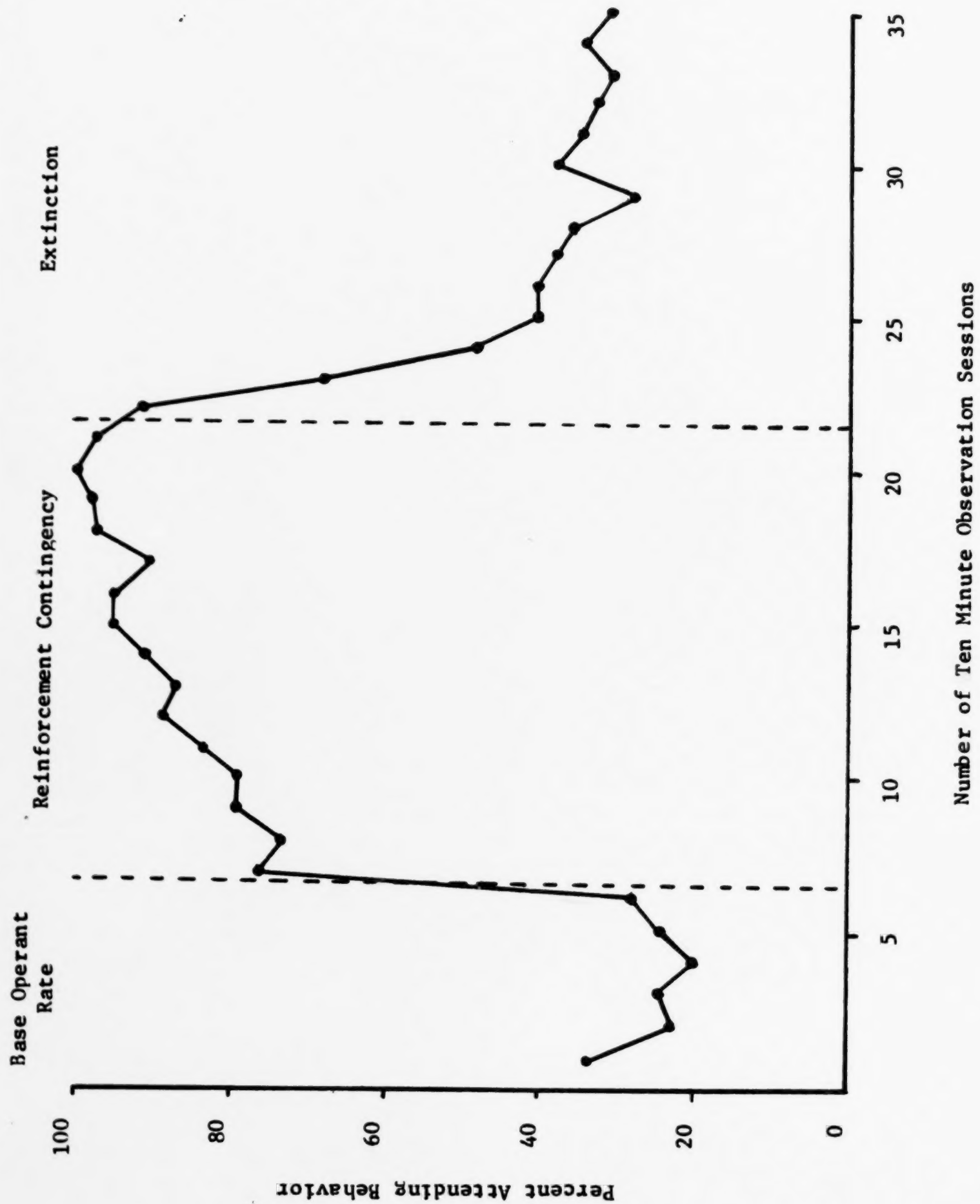
*Completed 3 intervals to criterion

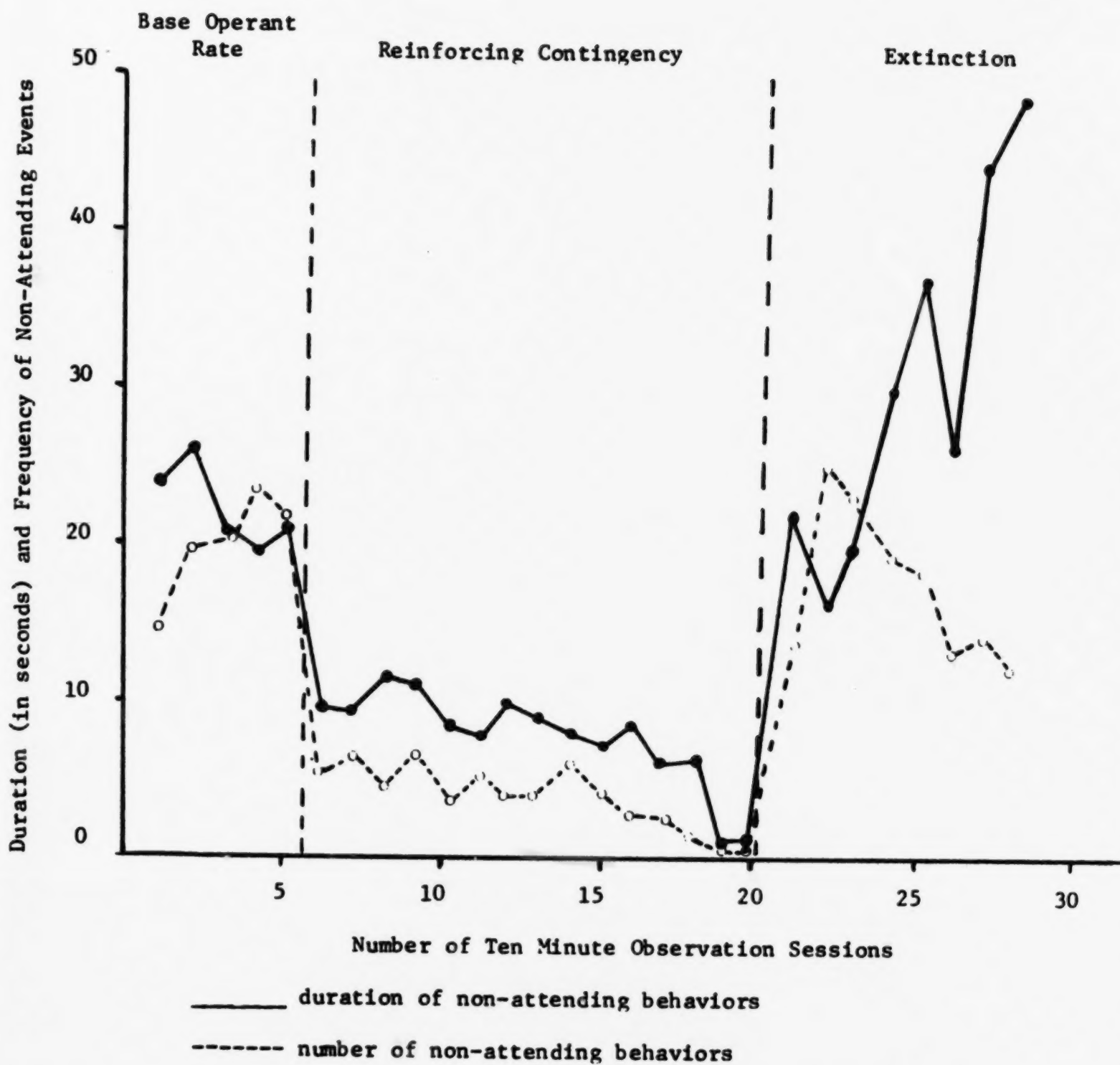
Figure Captions

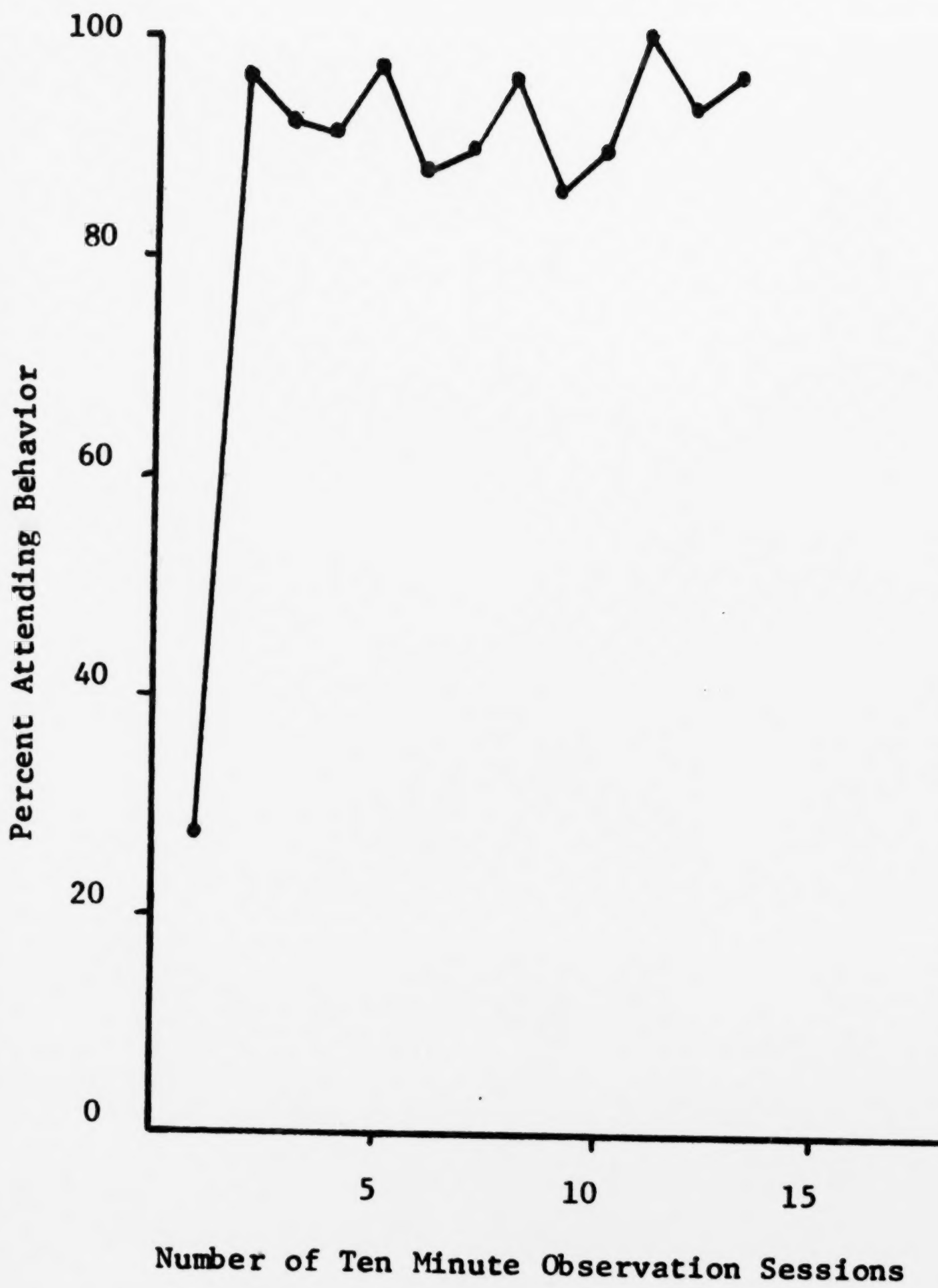
- Fig. 1 Sample Observation Form
- Fig. 2 Percentage of Attending Behavior in Successive Time Samples
- Fig. 3 Mean Duration and Frequency of Non-Attending Events Per
 Ten Minute Session
- Fig. 4 Proportion of Attending Behavior in the Regular Classroom

* 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Z	✓	✓	✓	✓	✓/	✓/								Z	✓	✓	✓				Z		Z	✓	✓	✓	✓	✓/	✓/

* Each time interval represents 10 seconds.







Effects of Reinforcement, Punishment,
and Feedback Upon Academic
Response Rate¹

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Abstract

Effects of reinforcement, punishment, and feedback upon academic response rate were evaluated using a fifth grade experimental subject and a fourth grade control subject from a behavior problem classroom. Also evaluated were the interactive effects of different combinations of these variables upon academic response rate. The subjects, matched on mathematical ability, received identical sets of one movement division problems during the experiment. However, reinforcement, punishment and feedback were introduced and manipulated only with the experimental subject.

Results indicated positive reinforcement and positive feedback were very effective in accelerating rate correct and decelerating error rate. Negative feedback and punishment were less effective in controlling error rate and in accelerating rate correct. In two of the three sessions in which punishment and negative feedback procedures were used; the error rate exceeded the correct rate. Conversely, the correct rate exceeded the error rate in the three sessions in which positive feedback and positive reinforcement procedures were used. The manipulation of positive and negative variables in combination within the same session produced interaction effects. The results of the study provide support for Marshall's (1965) hypothesis regarding the informational versus motivational functions of punishment. Punishment of specific error responses proved superior to applying punishment to the experimental situation.

A number of studies have been conducted documenting the relative effects of reward and punishment upon performance in children (Anderson, 1936; Anderson, White, and Wash, 1966; Baer, 1961; Bevan, 1957; Brackbill and O'Hara, 1958; Cheyne and Walters, 1969; Church, 1963; Forlano and Axelrod, 1937; Hamilton, 1969; Hurlock, 1924; Irwin, 1969; Levine, 1962; Marshall, 1965; Meyer and Offenbach, 1962; Penny and Lupton, 1961; Postman, 1962; Roberts, 1969; White, 1967; and Van De Riet, 1964). The available evidence is equivocal as to the superiority of either reward or punishment. However, a larger number of studies reported in the literature support the use of punishment and negative reinforcement procedures in accelerating learning and performance in children. These studies have also shown punishment effects to be mediated by intellectual, experimental, and situational variables. Some of these variables include task complexity, strength of association, intellectual level, achievement level, delay of reinforcement, instructions, pre-experimental satiation, subject's personality, experimenter, and atmosphere (Marshall, 1965).

Of more recent interest have been investigations of different combinations of reinforcing and punishing stimuli upon performance in children (Buchwald, 1959a, 1959b, 1962; Buss, Braden, Orgel and Buss, 1956; Buss and Buss, 1956; Curry, 1960; Meyer and Seidman, 1960, 1961; Spence, 1964, 1966, 1967). These studies have manipulated both verbal and non-verbal forms of reinforcement and punishment. While the above studies appear to have substantial clinical and experimental significance; their implications for direct classroom instruction appear to be limited due to the nature of the dependent variables used. These include concept formation tasks, Taffel type (1955) experimental tasks, arithmetic reasoning tests, intelligence tests, paired associate tasks and discrimination learning tasks. There appears to be a need for extension of research on reinforcement, punishment, and feedback

variables to performance on tasks of more educational relevance.

The amount of research conducted on the use of various combinations of reinforcing and punishing stimuli has substantially increased in the last few years. However, fewer studies have evaluated the interactive effects of these combinations upon performance rates. The purpose of this study was to investigate the effects of positive reinforcement, feedback, and punishment upon academic response rate. The study also evaluated the interactive effects of different combinations of these variables upon academic response rate.

Method

Subjects and Setting Conditions

The two subjects, one experimental and one control, were enrolled in an experimental classroom for behaviorally disordered children during two months of the academic school year 1969-70. Joyce, the experimental subject, had a chronological age of 12-1 at the beginning of the study and was enrolled in the fifth grade. Steve, the control subject, had a chronological age of 10-3 and was enrolled in the fourth grade. The subjects received grade equivalent scores of 2.9 and 2.8 respectively upon the computation subtest of the Stanford Diagnostic Arithmetic Test. The two subjects were selected for the study from a group of six children in the experimental classroom. They were matched as closely as possible upon arithmetic ability and a flip of the coin was used to designate Joyce as experimental and Steve as control.²

The study was conducted in a room, adjacent to the main classroom, used for tutoring and individual work. The setting contained a table, two chairs, a lamp, and the educational materials used during the study. The experimental task consisted of four, twenty item sets of basic number facts. Each stimulus

item was a simple division problem using one digit numbers. The dividers and quotients ranged from zero to nine. The dividends were multiples of the dividers and the quotients were always whole numbers. Sample problems from the four sets include: $45 \div 9 = \square$; $48 \div 6 = \square$; $8 \div 1 = \square$.

No problem was repeated within any of the four sets. Individual problems were assigned to the four sets using a random assignment without replacement procedure. Four by six inch cards containing the problems were used for this purpose. Twenty cards were dealt into a stack that was designated set one. The remaining cards were reshuffled and a second stack of twenty cards were dealt and designated as set two. This procedure was duplicated for sets three and four.

Control Variables

During the study a session consisted of completion of all four sets of problems in the order presented. A session was designated as experimental or control depending upon whether one of the independent variables was manipulated during the experimental task. A table of random numbers was used to randomly sequence the order of presentation of the four sets of problems during baseline, experimental, and control sessions. For example, the order of presentation of the four sets in experimental phase one was 1, 4, 2, 3. In the following control condition, it was 4, 2, 1, 3. In experimental phase two, the presentation order was 3, 2, 1, 4. This procedure insured a random presentation of the sets throughout the experiment.

The two subjects were exposed to either one experimental or one control condition each day. They were taken from the main classroom to the study setting during their math period and returned upon completion of the session. Neither subject received any formal math instruction in the experimental classroom during the study. The experimental and control subjects experienced

identical conditions throughout the study except for the experimental contingencies manipulated. The experimental subject was exposed to a multiple baseline procedure in which experimental and control sessions were alternated. The control subject was exposed to a constant baseline condition in which he received the same number and same order of presentation of problems as the experimental subject in each session. This procedure was designed to control for both practice effects and the influence of extraneous variables. The experimenter ran the subjects through the conditions one at a time. On one day, he chose the experimental subject first and on the next day, he chose the control subject first. The two subjects were alternately chosen throughout the study.

During each session, the subject was brought into the study area, given the instructions for that session, and presented with the experimental task. The sets were presented in the prescribed order for that session and timed with a stopwatch. An eight by ten inch piece of index weight paper with a one-half inch square cut in the middle was used to present each problem in isolation. This was used to pace the subject's performance during the set, to focus his attention on the problem being presented, and to preclude generalization between similar problems contained in the same set e.g. $72 + 8 = \dots$ versus $72 + 9 = \dots$. The experimenter placed the index paper over the first problem in the set and waited until the subject made a response and indicated he was ready to go on to the next problem. At the beginning of the study, both subjects required twenty-five to thirty minutes to complete the four sets of problems in one session. At the end of the study, they required only five to ten minutes per session.

Procedures

The experimenter, a graduate student in special education, was given a list of general instructions to read to both subjects. He was also provided with a list of specific instructions for each baseline, experimental and control condition. The experimenter ran both subjects through a two session baseline period after reading the list of general instructions. Questions or attempts to solicit information from the experimenter during subsequent phases were parried with, "complete the work sheet". The general instructions for both subjects were, "For the next few weeks you will be coming in here for a short period of time each morning to do some division problems. These are in no way related to your regular class assignments:

"Before you is a series of twenty division problems. You are to finish each problem. I will cover the list of problems with this card. When you finish a problem, say 'O.K.' and I will move to the next problem. You may take as long as you want on any one problem but you cannot go back to previous problems once the card has been moved down.

"Do you have any questions? Ready? Begin."

The experimenter was told that questions could be answered only by repeating portions of the above instructions. If the question was irrelevant, he was to ignore it and say, "Complete the following problems." The list of instructions for the experimenter and directions for the subjects during the nine experimental condition's are presented below.

1. Positive Feedback: Experimenter says "That's right!" for each correct response and says nothing for incorrect responses.
2. Negative Feedback: Experimenter says, "That's wrong!" for each incorrect response and says nothing for correct responses.
3. Positive and Negative Feedback: Experimenter

says, "That's right!" for each correct response and says "That's wrong!" for each incorrect response.

4. Positive Reinforcement: Experimenter says, "Today, we are going to try something different. For each problem you get right, you will get one point. I will let you know the number of points you have earned at the end of the session. These points will be saved on a sheet of paper and transferred to the display board in the classroom at the end of the experiment." "Ready?" "Begin." Experimenter tells subject the total number of points earned but does not enumerate which problems he earned them for. In the following control session, experimenter says, "Today you will not receive points for the problems you do." "Complete the work sheet." "Ready?" "Begin."

5. Punishment: Experimenter says, "For each problem you miss today, you will lose one point from the points you have already earned." "Ready?" "Begin." Experimenter tells subject the total number of points lost at the end of the session but does not enumerate which problems he lost them for. In the following control session, experimenter says, "For the problems today you will neither gain points for correct problems nor lose points for incorrect problems." "Complete the work sheet." "Ready?" "Begin."

6. Positive Reinforcement and Punishment: Experimenter says, "For each problem you get right today, you will get one point. For each problem you miss, you will lose one point. I will let you know both the number of points you have earned and those you have lost at the end of the session." "Ready?" "Begin." In the following control session, experimenter says, "For the problems today you will neither gain points for correct problems nor lose points for incorrect problems." "Complete the work sheet." "Ready?" "Begin."

7. Positive Reinforcement and Positive Feedback: Experimenter says, "For each problem you get right today, you will earn one point. I will let you know the number of points you have earned at the end of the session." "Ready?" "Begin." Experimenter also says, "That's right!" for each correct

response. In the following control session, experimenter says, "For the problems today, you will neither gain points for correct problems nor lose points for incorrect problems." "Complete the work sheet." "Ready?" "Begin."

8. Punishment and Negative Feedback: Experimenter says, "For each problem you miss today you will lose one point from the points you have already earned." "Ready?" "Begin." Experimenter also says, "That's wrong!" for each incorrect response. In the following control session, experimenter says, "For the problems today, you will neither gain points for correct problems nor lose points for incorrect problems." "Complete the work sheet." "Ready?" "Begin." 9. Positive Reinforcement and Positive Feedback Plus Punishment and Negative Feedback: Experimenter says, "For each problem you get right today you will get one point. For each problem you miss you will lose one point. I will let you know both the number of points you have earned and those you have lost at the session." "Ready?" "Begin." Experimenter also says, "That's right!" for each correct response and "That's wrong!" for each incorrect response. In the following control session, experimenter says, "For the problems today you will neither gain points for correct problems nor lose points for incorrect problems." "Complete the work sheet." "Ready?" "Begin."

The experimental subject was informed of her net total of points at the end of each experimental session. At the end of the study, they were transferred to her point total on an electronic display board used for automatically recording points in the experimental classroom. Points could be exchanged for a variety of back-up reinforcers including marking pens, candies, toys, models, games, and free time to engage in high frequency activities. One point was equal to one minute of free time and was equivalent to one cent toward the cost of a back-up reinforcer.

For the control subject, the experimenter was instructed to begin each session during the experiment with, "Complete the work sheet."

Results

Rate Changes Across Sessions

Control Subject

The control subject had an average rate of 4.72 per minute during baseline 1. His rate correct for the same period was 3.17 and his error rate was 1.55. During baseline 2, at the end of the experiment, the control subject's average rate had increased to 18.52. His rate correct during baseline 2 was 10.98 and his error rate was 7.54. The control subject's performance increased to a maximum average rate of 19.25 per minute during control phase thirteen and stabilized at this approximate value for the remainder of the experiment. Although his total average rate increased markedly during the experiment, the control subject's correct and error rates maintained their relative proportions. His rate correct exceeded his error rate in seventeen of the nineteen sessions. In control phase nine, his error rate was slightly higher than his correct rate and in phase ten, the two rates were equal. Thus, the control subject's performance showed a definite practice effect over experimental sessions. However, both rate correct and error rate contributed equally to such an effect.

Experimental Subject

The experimental subject's average rate during baseline 1 was 8.69 per minute. However, her error rate of 5.92 per minute was substantially higher than her correct rate of 2.77 responses per minute. The experimental subject's error rate during baseline 1 was higher than the control subject's total, average rate for the same period. The experimental subject's total, average rate increased, from 8.69 responses per minute during baseline 1 to a rate of 21.25 per minute during baseline 2. This compares to a rate of 18.25

per minute for the control subject during the same period. The experimental subject's error rate averaged 11.17 responses per minute during baseline 2 and her rate correct averaged 10.08 per minute. Her error rate increased from 5.92 per minute during baseline 1 to 11.17 during baseline 2 while her correct rate increased from 2.77 to 10.08 for the same period. The experimental subject's performance showed a substantial increase in rate during the experiment. However, the rate increase was quite irregular as a result of its interaction with manipulation of the contingencies during experimental sessions. The control subject's performance showed a gradual, more regular increase in rate across experimental and control sessions.

During the first experimental condition, positive feedback for correct responses, the experimental subject's error and correct rates were reversed over baseline 1. Rate correct increased to an average of 5.37 responses per minute and the error rate decreased to an average of 4.21 responses per minute. In the following control phase, error rate recovered its baseline 1 level while the rate correct of 5.37 was identical to the correct rate in experimental condition one. However, inspection of figure 1 indicates the correct rate was negatively accelerating during this control phase.

Insert Figure 1 About Here

The error and correct rates did not change appreciably from control phase one to experimental condition two. The total average rate was slightly lower during this experimental condition but the distribution was very similar to that in the preceding control phase. During control phase two, however, the error rate increased substantially to an average of 11.25 responses per minute while the correct rate decreased to an average of 5.22 responses per minute.

In experimental condition three, the negative acceleration of the correct rate was reversed. The error rate decreased to its approximate level during experimental condition two. During control phase three, the total average rate increased substantially with both error and correct rate showing an increase.

The error rate decreased from an average of 11.50 per minute during control phase three and stabilized at 8.00 responses per minute in experimental condition four. The correct rate increased to an average of 10.70 per minute but the rate varied from 6.50 to 14.00 per minute within the session. In control phase four, the correct and error rates were again reversed. The error rate recovered and surpassed its level in control phase three at an average of 12.62 responses per minute. Rate correct decreased to an average of 6.50 for the session.

During experimental condition five, both error and correct rate stabilized initially at a value of approximately six responses per minute. However during the second half of the session, error rate, and to a lesser extent correct rate, showed a positive acceleration trend. In the following control phase, error rate stabilized at a rate of 11.67 per minute while correct rate continued its positive acceleration.

In experimental condition six, both error and correct rate were exceptionally stable. Both rates were also nearly equal. Error rate averaged 10.86 responses per minute and rate correct averaged 9.25 per minute. During the next control phase, error rate increased dramatically to an average of 18.21 responses per minute. The increase was rather abrupt and did not show a gradual increase within the session. Rate correct showed a decrease to an average of 8.32 responses per minute with some positive acceleration toward the end of the session.

During experimental condition seven, error rate decreased from 18.21 responses per minute to an average of 7.41 per minute. This compares with an error rate of 10.86 during experimental condition six. The correct rate during experimental condition seven remained stable at 8.24 responses per minute.

The error rate in control phase seven averaged 10.77 per minute. The rate was extremely variable, however, and ranged from 7.75 per minute to 15.35 per minute. The correct rate increased to 10.32 responses per minute and showed less variability than the error rate.

During experimental condition eight, the correct rate was more variable than the error rate. The correct rate increased to an average of 10.85 responses per minute. The rate varied from 6.61 to 15.00 per minute. The error rate was fairly stable and averaged 7.45 responses per minute. In control phase eight, the error rate increased substantially to an average of 13.47 per minute. The rate correct stabilized around an average of 10.60 per minute and showed very little variability.

In experimental condition nine, the correct rate increased to an average of 14.28 per minute and showed some positive acceleration toward the end of the session. The error rate decreased to 8.38 responses per minute and showed a trend toward negative acceleration on the last trial in the session. During the following, two-session baseline period, the correct rate decreased to 10.08 responses per minute while the error rate accelerated to 11.17 responses per minute.

Experimental Intervention Effects

The use of positive feedback and positive reinforcement was very effective in accelerating rate correct and decelerating error rate in the study. During experimental conditions one, four, and seven, positive feedback and positive

reinforcement were manipulated singly and in combination. The average rate correct in these three sessions was 7.87 per minute and the average error rate was 6.54 per minute. Reversal effects were obtained in the control phases that preceded and followed each of the three experimental conditions. In the control sessions that preceded and followed experimental conditions one, four, and seven, the average rate correct was 6.79 per minute and the error rate was 10.82 per minute.

Negative feedback and punishment procedures were less effective in controlling error rate and in accelerating rate correct. Negative feedback and punishment were used singly and in combination in experimental conditions two, five, and eight. The error rate exceeded the correct rate in sessions two and five and the correct rate exceeded the error rate in experimental condition eight. Reversal effects were obtained with experimental condition eight but it was not possible to isolate such effects with experimental conditions two and five.

In experimental conditions three, six and nine, positive and negative variables were manipulated in combination within each session. In session three, positive feedback for correct responses and negative feedback for incorrect responses produced error and correct rates that were approximately equal. During control phases two and three, reversal effects were more clearly produced in error rate than in rate correct. In experimental condition six, positive reinforcement for correct responses and punishment (response cost) for incorrect responses again produced error and correct rates that were approximately equal. Reversal effects were obtained for both correct and error rates. However, reversal effects were again more clearly evident in error rate, especially in control phase six. In experimental condition nine, positive feedback and positive reinforcement followed correct responses and negative feedback and punishment followed incorrect responses. The

interaction of these variables was more effective than either of the two combinations in sessions three and six in reducing the error rate and increasing the correct rate. Rate correct showed a substantial increase over the rate in control phase eight and error rate showed a substantial decrease.

Discussion

The results of this study, on the effects of punishment, provide support for Marshall's (1965) hypothesis regarding the informational versus motivational functions of punishment. He hypothesizes that negative reinforcement of specific responses has discriminative or informative value whereas negative reinforcement applied to the situation (e.g., after a series of responses or trials) may have a motivational function. Marshall states that, "whether the increased motivation leads the subject to be more aware of appropriate cues or whether its effect is disruptive may depend on other factors in the situation: e.g., strength of negative reinforcement, task difficulty, achievement orientation. According to this hypothesis, one might predict that reinforcing each response would be informative and hence more beneficial. On the other hand, if negative reinforcement after a series or after the situation serves as a motivator, its beneficial or detrimental effects would be likely to depend on other factors in the situation"(p. 30). During experimental condition five, punishment was applied at the end of the session when the experimenter subtracted one earned reinforcer for each error recorded on the experimental task. The subject was told the number of points she had lost at the end of the session. She received no feedback about the specific error responses that resulted in the point loss. During experimental condition eight, points were also subtracted for error responses at the end of the session. The subject was informed at the start of the session that she would lose one point for each incorrect response. Throughout the session, the

experimenter said "That's wrong" for each incorrect response the subject made. Thus the subject received information or feedback on error responses during this condition. The procedure resulted in punishment of specific responses since each time the experimenter said, "That's wrong" the subject had lost one point. Punishment delivered at the end of experimental condition five had a negative rather than a facilitating effect upon performance. The error and correct rates did not change their level or relative positions from the preceding control phase. Punishment of specific responses in experimental condition eight, however, had a substantial effect in accelerating rate correct and in decreasing error rate. Reversal effects were clearly produced for error rate in the preceding and following control phases. Punishment applied to the situation rather than to specific responses tended to disrupt rather than facilitate the experimental subject's performance. The dramatic increase in error rate in control phase six may be a result of the application of punishment, in combination with positive reinforcement, in experimental condition six.

The results of this study on the effects of positive and negative feedback on performance are not in agreement with a number of studies with adults (Buchwald, 1959a, 1959b, 1962; Buss, Braden, Orgel, and Buss, 1956; and Buss and Buss, 1956) and with children (Curry, 1960; Meyer and Seidman, 1960). In these studies, saying "right" for correct and "wrong" for incorrect responses and saying nothing for correct responses and "wrong" for incorrect responses produced higher rates of responding and faster speeds of acquisition than saying "right" for correct responses and nothing for incorrect responses. In this study, saying "right" for correct and nothing for incorrect proved more effective than saying "wrong" for incorrect and nothing for correct responses or saying "right" for correct and "wrong" for incorrect

responses within the same session. There seemed to be no difference between the interventions in experimental phases two ("right" for correct) and three ("right" for correct plus "wrong" for incorrect). However, the fact that rates of responding were nearly equal in these two sessions is consistent with the finding in the above studies that acquisition rates were usually the same for the "right" plus "wrong" and nothing for correct and "wrong" for incorrect responses. (Doctor, 1969).

The experimental sessions in which positive and negative feedback, positive and negative reinforcement, and positive feedback and reinforcement plus negative feedback and reinforcement were used in combination produced clear interaction effects in two of the three sessions. In experimental conditions three and six, the combinations produced error and correct rates that were approximately equal. In condition nine, the combination of positive feedback plus positive reinforcement for correct responses and negative feedback plus negative reinforcement for incorrect responses was very effective in decreasing error rate and accelerating rate correct. This result is consistent with Marshall's (1965) hypothesis regarding punishment of specific responses versus applying punishment to the situation in which the performance occurs. In experimental condition nine, the subject was receiving maximum feedback and reinforcement for her responses. Further, the feedback and reinforcement were delivered immediately upon completion of each response thereby maximizing the amount of information the subject was receiving for each response.

The results of this study suggest that learning and performance on educational tasks will be most efficient under conditions where the student receives maximum feedback as to the correctness of a response as soon as it is produced. The effectiveness of punishment seems to be derived from its informational rather than its motivational properties. Thus if punishment

is to be used, it should be applied to specific error responses rather than to the learning or performance situation. The use of positive reinforcement and positive feedback for correct responses was quite effective in accelerating correct rate and decreasing error rate. The use of these procedures alone or in combination with negative feedback and punishment for specific error responses would appear to maximize the potential for efficient learning and performance in the classroom setting.

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Footnotes

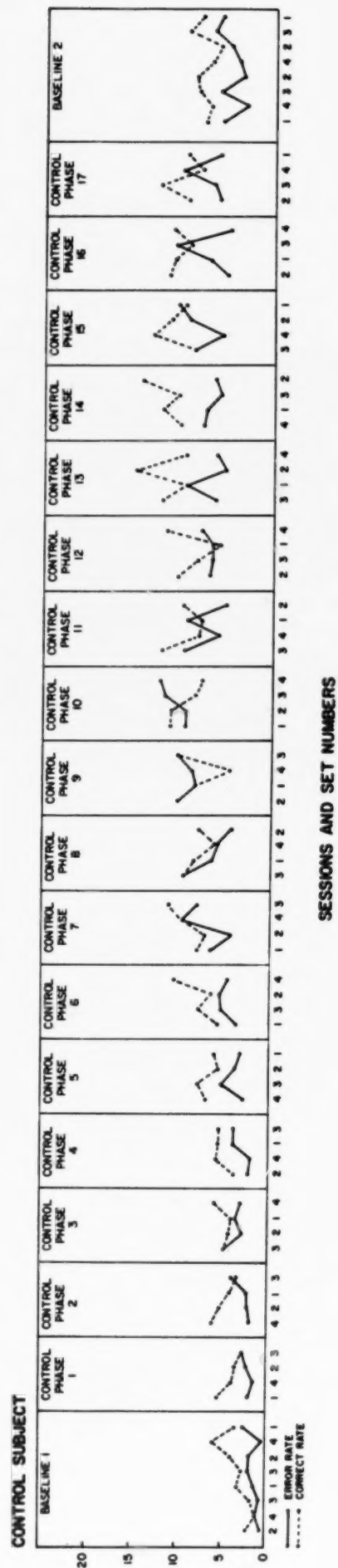
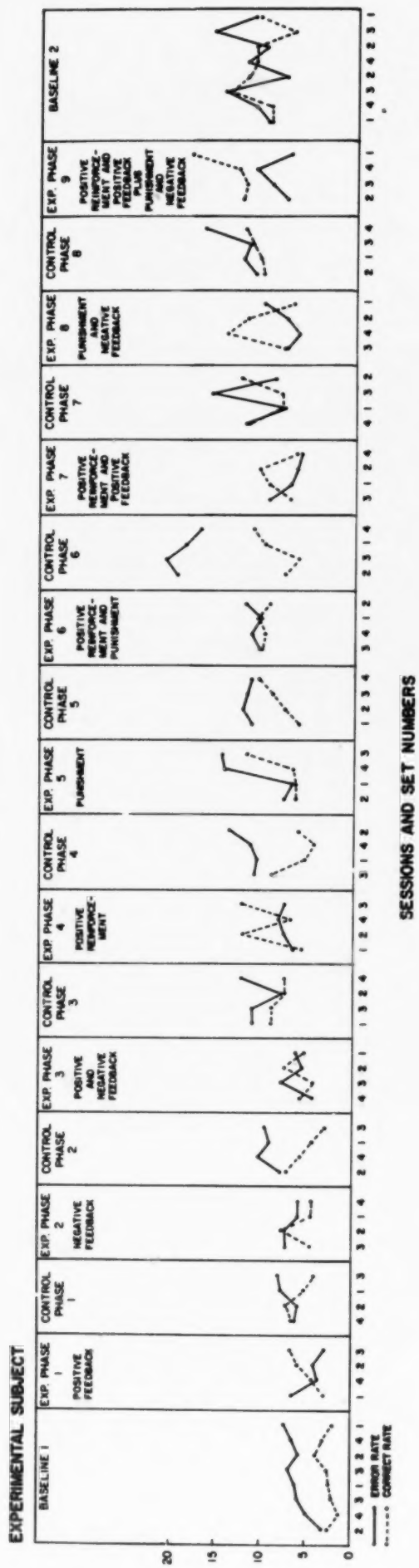
1. This research was supported by a grant from the U. S. Office of Education, Division of Research, Bureau of Handicapped Children and Youth, U. S. O. E. Grant #OEG 4-6-061308-0571 Assessment and Treatment of Deviant Behavior in Children.

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2. The authors are aware of the possible mediating effects that the experimental and control subjects' age and sex differences could have upon their performance during the experiment. However, matching on some measure of mathematical ability was of major importance in the design of this study. It was not possible to match on age, sex, and mathematical ability among the six subjects enrolled in the experimental classroom. Thus, the authors chose to match on mathematical ability and let age, sex, and intellectual variables vary.

Figure Captions

Figure 1 Effects of Experimental Intervention and Control
Phases Upon Performance Rates of Experimental and
Control Subjects



Using Group Reinforcement Procedures to Increase Cooperative Social Interactions¹

Nancy Buckley and Hill Walker

In recent studies, the field of behavior therapy has begun to change its focus from individualized treatment programs to development of group intervention procedures. These studies have used group reinforcement procedures to produce changes in group as well as individual performance.

Most of the applied work with groups of children has been in the academic classroom setting (e.g., Cantrell, Cantrell, Huddleston, and Woolridge, 1969; Barrish, Saunders and Wolf, 1969; Walker, Mattson, and Buckley, 1969; Schmidt and Ullrich, 1969).

In studying cooperative play, researchers have focussed on one child and used adult social reinforcement (Buell, Stoddard, Harris, and Baer, 1969; Hart, Reynolds, Baer, Brawley and Harris, 1969). Tokens dispensed on an individual basis, have been used with mentally retarded girls in a residential cottage whenever they engaged in "constructive socially acceptable activities." (Girardeau and Spradlin, 1964).

The present study grew out of a need to reduce the amount of fighting and aggression on the playground for a group of behaviorally deviant children. The goals were to allow the teacher to have more control over the recess periods and hopefully to help the children get along better with their peers. It was felt that these goals could be achieved by reducing the number of negative comments and increasing the number of positive comments expressed to peers.

These children use assertive behavior to coerce reactions from their environment (Patterson, Littman, Bricker, 1967)

"The behavior of the very withdrawn, the delinquent, or the noisy child are all equally coercive in that they force a respondent to emit only responses from a narrow range within his potential repertoire." (p.2).

Raush. (1965) found that the stimulus act immediately preceding was a major determinant of a person's response. In his study, approximately 75% of the cases of hostile behavior elicited unfriendly responses. Conversely he found that "cordial antecedent acts" seldom elicited hostile behavior. He concluded that aggressive children thus created through their own actions a hostile environment, whereas children who displayed friendly interpersonal modes of response generated an amicable social milieu.

He also found that in a game situation 42% of the antecedent acts by American "normal" children were unfriendly. When an unfriendly antecedent

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occurred, hyperactive boys responded with only a slightly higher percent of unfriendly responses than normal boys. However, the hyperactive boys gave much fewer positive responses to friendly antecedents than the normal boys.

Two early studies looked at verbal statements of sixth grade children in response to reasons for choosing friends. Kuhlen and Lee (1943) found the largest difference between popular and unpopular peers on the dimension of "cheerful and happy; enthusiastic; friendly".

Austin and Thompson (1948) found the 10 most common reasons for choosing friends among 400 sixth grade children to be: cheerful (12.2%); nice and friendly (11.5%); frequent association (11.3%); similarity of interest and taste (10.9%); kind (7.9%); cooperative (5.7%); generous (5.7%); honest (4.6%); even-tempered (4.5%);, and polite (3.2%).

We can assume that being "happy, enthusiastic, friendly, kind and cooperative," etc. involves high frequency positive interactions and comments and low frequency negative interactions and comments. Thus, by altering positive and negative comments we should make children better liked among their peers.

The hypothesis was that if the children began making positive antecedent statements and responses they would start receiving social reinforcement from their peers and thus the play situation would maintain the behavior. Early data would tend to support this hypothesis.

Doob (1947) felt an attitude was an anticipatory response which mediates overt behaviors and comes out through positive reinforcement, as with a habit. Thus an opinion could originally be expressed without the supporting attitude. If this verbal behavior is rewarded, then the corresponding attitude, through pairing, may come to mediate subsequent opinion in the presence of similar cues.

To test this hypothesis, Scott (1957) used 72 college sophomores. He found that the students who won the debate (a presumed reinforcer) showed more change in the direction of their side of the debate issue than those who lost. In addition, experimental tasks have shown peers to be effective reinforcers in altering preference in a marble dropping task (Patterson and Anderson, 1964) and in a cooperative task for three member groups (Mithaug and Burgess, 1967).

Method

Subjects

The six subjects -- two girls and four boys -- were in grades 3 - 5 (ages 9.5 to 11.2). The subjects were all average or above in intelligence (Wisc/Binet). During the experiment they were enrolled in a special classroom because of acting-out, aggressive histories in the regular classroom setting.

The teachers of each of the six subjects filled out a checklist (Walker, 1970) prior to enrollment in the special class. On behaviors relevant to the study the following items were scored as present in the child:

Item #		# of children exhibiting behavior (N=6)
14.	Disturbs other children: teasing, provoking fights, interrupting others.	(6)
37.	Has no friends.	(5)
39.	Displays physical aggression toward objects or persons	(6)

On a fifth item (#45), "Does not initiate relationships with other children" only one teacher recorded the behavior present in one of the six children. This reaffirms the observations that it is not the failure to interact with peers but the inappropriateness of the interactions that is the major problem.

Setting and Materials

The subjects had two, twenty-minute recess periods; 10:30-10:50 and 12:40 to 1:00. During these times they were allowed free play on the school playground. The setting remained constant throughout baseline and contingency manipulation. During this time the six subjects were the only children on the playground.

The playground was a fenced, black-top area (approximately 51 yd x 59 yd.) adjacent to the classroom. Equipment in the area included swings and a jungle-gym. Sections of the playground were also marked off for baseball and four-square. In addition, the children had access to two rubber balls.

Observations

The experimenters recorded total number of positive interactions and total number of negative interactions by the six children during each recess period.

Positive interactions were recorded when a child:

- a. Initiated with a positive comment, e.g.,
 - ☐ invited another to join game
 - ☐ complemented playing ability
 - ☐ comment allowing another to go first
 - ☐ friendly comments
- b. Responded with positive comment
 - ☐ "thank you"
 - ☐ friendly response to friendly comment
 - ☐ remaining neutral to unfriendly comment
- c. Initiating or responding with positive gesture
 - ☐ any overt body movements indicating pleasure with another person or his performance (other than touching).

Negative interactions were recorded when:

1. Child initiated or responded with negative verbalization
 - a. Negative comments about person or personality. "you're an idiot" "you m.r."
 - b. Attempts to isolate a child or pressure others against him.
"Don't throw the ball to ----"
"Don't let him in line"
"Let's not play with ----"
 - c. Criticism of playing ability "you can't catch the ball", etc.
 - d. Implication of unfairness
 - e. Bragging
2. Child initiated or responded with negative gesture -
 - a. threatening gestures - e.g., splashing water, negative hand movements, teasing by pretending to trip or hit child, or grabbing something belonging to the child.
 - b. Shoving, pushing, hitting or any kind of direct contact of a negative nature.

The experimenters, prior to baseline observation, recorded exact wording of all verbal comments. From this they were able to more clearly define categories of positive and negative statements. This also allowed the subjects to acclimate to the experimenters.

During baseline and treatment a tally was kept of total number of both positive and negative comments and gestures for each recess period. Both a frequency count and rate were obtained. After 3 days of joint observations reliability of category coding (positive or negative) approached 100% with the two observers. Reliability in total number of tallies was above .90.

Because the children were the only six on the playground and the observers remained in close proximity it was possible to hear and record all comments. The frequency count was kept on two wrist golf counters (one plus; one minus).

Baseline

During baseline the children had "free" recess periods where they were allowed to play anything they wanted. The teachers did not intervene in any way unless a fight occurred. Observations were taken continuously during the 2 recess periods daily.

Intervention I

A group strategy appeared to be the most feasible in terms of the zero operant level for positive reinforcers. With previous groups of children both shaping and modeling procedures were effective in developing group play skills. However, none of the children presented acceptable behaviors for modeling and to shape in such low rate behaviors would have involved more time than the experimenters had available (5 weeks).

The children were told by the teacher that as a class "we are all going to try to get along better at recess. And that we (the teachers) had some ways that we could help them."

Each child was given a small sheet of paper with 'playground rules' (see Figure 1).

Rules for free time

Points EARNED for:

1. Nice statements - "good catch", etc.
2. Sharing ball
3. Consideration for classmates
 - inviting someone to join in game
 - not crowding in front to be first in line or grabbing ball
4. Walking well in line
 - first person holds door
 - no kicking or touching of classmates

Points LOST for:

1. Not playing with one classmate. May pair up but don't leave anyone to play by himself.
2. Putting hands on another person for any reason not required by game.*
3. Making threatening gestures at another person. This includes teasing of any kind, splashing water, etc.
4. Saying unkind comments
 - criticism of playing ability
 - name calling
 - implication of unfairness
5. Throwing the ball in the wrong direction or hard so someone can't catch it.
6. Bragging
7. Talking to teachers**

*The authors have recorded high rates of touching and physical contact by these children and previous groups as well. Even when the initiation starts out positively (e.g., arm around shoulder) it often goes into a physical altercation (e.g., choking with arm). Therefore we were interested in reducing the overall rate. Also, because of the nature of physical contact it makes it difficult to categorize as positive or negative. So it was decided to simply subtract a point for any physical interaction with another peer.

**Since the teachers (experimenters) were, of necessity, in close proximity this rule was included so the children would not attempt to use teachers to mediate in rule's regarding game or interactions.

Figure 1 - Playground rules

As the children read the rules to themselves the teacher read them orally. Discussion with the six subjects followed each rule to determine their understanding of the rule and to elicit examples from them. The use of verbal modeling has been previously supported. (Bandura, 1969)

"The use of verbal forms of modeling makes it possible to transmit an almost infinite variety of values and response patterns that would be exceedingly difficult and time consuming to portray behaviorally." (p. 146).

The children were told that they could earn points for being cooperative with each other on the playground. Since they were already earning individual points for academic work behavioral contracts were familiar to them.

The children were also told they would lose one point each time they emitted an inappropriate behavior as specified on their list.

The children were told that once they earned 500 pts. they would go on a group trip to a place of their choice. This was modified by having them sample the reinforcer after 25 pts. (see Results section).

Each time the group earned a point the teacher rang a bell so the children knew immediately the behavior for which they were being reinforced. Each time a child emitted a negative response or gesture the teacher blew a whistle. For example, a child catches the ball and a peer says "nice catch" (bell + 1 pt). If the child responds with "thank you" or some other appropriate comment (bell + 1 pt); however, if he says something like "shut-up" (whistle, 1 pt. lost). The children voted on the noise which would signal points-earned and that which would signal points-lost.

Intervention II

Feed back from the data indicated the negative interactions after an initial depression were increasing toward baseline levels. These negative interactions were primarily on the part of two students. The negative comments they made were cancelling out the points earned by the rest of the group.

Thus the experimenters introduced an individual component into the intervention. If a child made a negative comment at recess he was immediately sent into the classroom to work for the remainder of the period. While he was in he was given a mimeographed sheet of work which was not part of his regular assignment. He was required to complete the sheet but was given no points, and the sheet was easy enough that an adult should not have to interact with him. The teacher aide normally stayed in during recess to file papers so she was able to supervise the child (from a distance) without interacting.

Follow-up

Because of the time constraints (the children were to be returned to their regular classrooms) the experimenters were unable to get follow-up data. Generalization data to the physical education period was available, however.

Results and Discussion

Figure 2 shows the average number of social interactions, positive and negative, for the two recess periods daily. The median number of negative interactions during baseline was 18.5; during intervention I, 10.0; and during intervention II, 3.0. Median positive interactions were 0 for baseline; 18 for intervention I; and 39 for intervention II.

Insert Figure 2 about here

Initially the subjects were allowed to earn a small number of points toward a trip to the ice cream parlor (next door to the school) as a sampling (Ayllon and Azrin, 1968) of the reinforcer available - a group trip. When the children neared the goal there was a dramatic increase in positive comments (see a) and a reduction in negative comments (see b). This same type of burst occurred prior to the 500 point group trip (c & d).

The variability of positive comments was presumed to be a function of the game situation (some games lend themselves to more social interaction) and also to the fact that their behavior was not yet under the complete control of intrinsic reinforcers. If intervention were continued, it appears this variability would have been reduced.

Generalization

At no time were points given for positive interactions or subtracted for negative interactions during the p.e. period. However, Figure 3 shows that the children were making positive comments during physical education. On only 3 of the 10 days observed did the children make more negative comments than positive.

Insert Figure 3 About Here

During intervention the number of different kinds of positive comments increased. In addition by week 3 all six children were making at least some positive comments daily.

Anecdotal information from the regular classroom teachers indicated the children continued to emit some positive comments two weeks after they were back in their regular classes.

Conclusions

Although there were dramatic changes in the social interactions of the six subjects the lack of reversal and generalization data limit the data's usefulness. Therefore, it is necessary to consider the data pilot work with its value being the implications it presents for future studies.

Most apparent for future investigations would be to provide reversal and generalization data using the procedural design discussed. In addition, it would be useful to separate positive and negative comments into antecedents and respondents. These could be manipulated separately to determine which brings about the greatest change. That is, do these children "turn off" their peers by negative antecedents or negative responses or a combination of the two? How often are positive antecedents followed by negative responses? Sociometric data would be useful in establishing that change has occurred in peer acceptance.

The data suggest that social interactions can be altered through positive reinforcement. The implication is also present that this alteration in positive comments made the situation itself more reinforcing to the children.

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